

Data Evaluation Record on the aerobic biotransformation of MS (5-Chloro-2-methylsulfonyl thiazole) in three European soils

MRID Number 48574829

Data Requirement: OECD Guideline: 307
EPA Guideline: 835.4100

EPA PC Code: 050410
DP barcode: 403340

Test material: MS (5-Chloro-2-methylsulfonyl thiazole)

Primary Reviewer: Martin LeMay, PMRA

Secondary Reviewers: James Lin, US EPA

EPA Signature: 

Date: April 25, 2013

This study was reviewed as part of a global review. Therefore, the data evaluation was prepared in monograph form. This preface is a supplement to the attached monograph section and documents the review of the study for EFED.

Results Synopsis:

This study is classified as **supplemental**, because the test chemical is a degradate and only 3 soils were tested. (PRMA: Acceptable/ reliable with restrictions)

CITATION: Brands C. (2011b). Determination of the Aerobic Degradation Rate of MS In Three Soils. Makhteshim Chemical Works, Ltd. Report No.: R-28472, 20 December 2011 (MRID 48574829)

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Guideline: EPA Guideline 835.4100
OECD Guideline 307

Deviations: none

GLP: Fully GLP compliant (laboratory certified by Netherlands VWA Authority)

Executive Summary:

The degradation rate of MS, a soil metabolite of fluensulfone, was investigated in three soils incubated at $20 \pm 2^\circ\text{C}$ in the dark for a period of 120 days according to the OECD 307 guideline. The following soils were used: Fislis (silt loam; France), Horn (loam; Switzerland) and Sevelen (sandy loam; Switzerland). Aliquots of soil (100 g dry weight) were treated with the test substance at a nominal concentration of 0.4 mg/kg dry soil. After treatment, the soil moisture content was adjusted to pF 2.5 by addition of Milli-Q water. The soil samples were incubated at $20 \pm 2^\circ\text{C}$ in the dark.

The efficiency of the analytical method for the determination of MS residues was tested at every sampling interval by fortifying untreated soil samples at different target concentrations ranging from 0.04 mg/kg soil (10% of initial) to 0.4 mg/kg (100% of initial). The mean values of all recoveries from the fortified samples were 104%, 98% and 94% for Fislis, Horn and Sevelen soil, respectively, thereby confirming the efficiency of the analytical method and the stability of the compound during the work-up procedure. The mean recoveries analysed for the time zero samples for the Fislis, Horn and Sevelen soils were 83%, 86%, and 89% of nominal concentrations.

The LOQ for the analytical method used corresponded to 5% of the initial amount applied. After 120 days of incubation in the three soils, 6-13% of nominally applied MS was recovered. The datasets were assessed using FOCUS kinetics recommendations to determine the most appropriate degradation kinetics.

The decrease of MS in Fislis soil could be described by Single First Order (SFO) kinetics. In the Horn and the Sevelen soils, the dissipation of MS was better described by an indeterminate order rate equation with respective half-lives of 24.1 and 23.1 days. The corresponding representative half-lives (T_R) for the Horn and Sevelen soils were 34.2 and 44 days.

I. MATERIALS AND METHODS

Test Materials:	5-Chloro-2-methylsulfonyl thiazole
Description:	Brown crystals
Lot/Batch:	231PAL052
Purity:	98.7%

CAS#:	--
Stability of compound:	The test item was stable in the application solution during the treatment of the soil samples, as shown by the fortified samples
Soil:	The soils were collected from specific field locations from the top 20 cm layer with restricted access managed to ensure that no pesticides or organic fertilizer treatments took place for at least five years prior to collection. The characteristics of the soils used are presented in Table 1 .

B. STUDY DESIGN

1. Experimental conditions:

Aliquots of soil (100 g dry weight) were treated with the test substance dissolved in 20/80 (v/v) acetone/Mili-Q water at a nominal concentration of 0.4 mg/kg dry soil using a treatment solution. After treatment, the soil moisture content was adjusted to pF 2.5 by addition of Milli-Q water. The soil samples were incubated at 20 ± 2 °C in the dark in flasks that allowed free exchange with the atmosphere. Two samples were treated with the same volume of solvent (20/80 (v/v) acetone/Milli-Q water) for the purpose of biomass determination at the end of the experiment.

The moisture content of the soils was kept at approximately pF 2.5 throughout the incubation period by checking moisture loss on a regular basis (every week) and adding Milli-Q water.

2. Sampling

Duplicate samples of each soil were taken after 0, 7, 15, 28, 42, 60, 91 and 120 days of incubation.

Microbial biomass was determined at pre-initiation and at the end of the incubation period to confirm that it met OECD guideline requirements.

3. Analytical Procedures

Soil samples were analysed on the day of sampling or after storage in the freezer ($\leq -15^{\circ}\text{C}$). However, the fortified samples showed the stability of MS in soil under storage conditions. At each sampling event (excluding $t=0$), a procedural recovery sample was spiked at the 100% level or 10% level and stored under the same conditions.

Soil samples were extracted with 200 mL 50/50 (v/v) acetonitrile/water at 200 rpm for 60 minutes (single step extraction). The extracts were analysed by HPLC-MS/MS. The efficiency of the analytical method for the determination of MS residues was validated and tested at every sampling interval by fortifying untreated soil samples at different target concentrations ranging from 0.04 mg/kg soil (10% of initial) to 0.4 mg/kg (100% of initial). The mean values of all recoveries from the fortified samples were 104%, 98% and 94% for Fislis, Horn and Sevelen soil, respectively, thereby confirming the efficiency of the analytical method and the stability of the compound during the work-up procedure. The LOQ for the analytical method

used corresponded to 5% (0.02 mg/kg) of the initial amount applied. The analysed concentrations were all higher than 0.02 mg/kg.

II. RESULTS AND DISCUSSION

A. Data

The concentrations of the test chemical (MS) with respect to time are presented in **Table 2**.

B. Dissipation Rates

During incubation, MS concentrations in soil decreased continuously. In Sevelen and Horn soil less than 10% of applied MS was recovered after 120 days of incubation. In Fislis soil, approximately 13% of nominal applied MS was recovered at the end of incubation.

MS dissipated from Fislis soil following Single followed First Order (SFO) kinetics; and from the Horn and Sevelen soils following Indeterminate order rate equations (IORE).

The dissipation plots according to FOCUS kinetics recommendations are presented in **Figure 1** to **Figure 3**. The calculated half- life (DT_{50}) of MS in Fislis, Horn and Sevelen soils, under aerobic conditions were 41.3, 24.1 and 44 days, respectively. Representative half-lives (T_R) of 34.2 and 44 days were respectively calculated for the Horn and Sevelen soils. These results are summarised in the **Table 3**.

III. Conclusions

For the Fislis soil, the decrease of MS could be described by Single First Order (SFO) kinetics; and for the Horn and Sevelen soils, dissipation was better described by Indeterminate order rate equation (IORE) kinetics. The half- life (DT_{50}) of MS was estimated to be 41.3 days in Fislis soil, 24.1 days in Horn soil and 23.1 days in Sevelen soil. Representative half-lives (T_R) of 34.2 and 44 days were calculated from the IORE dissipation curves of the Horn and Sevelen soils.

Table 1: Characteristics of the Soils Used

Name	Fislis	Horn	Sevelen
Location	Fislis, France	Horn, Switzerland	Sevelen, Switzerland
Batch number	2011	2011	2011
Soil characteristics			
pH-CaCl ₂	6.75	7.23	7.36
Organic carbon (%) ²	2.13	2.36	1.61
Cationic exchange capacity (meq/100 g soil) ²	22.99	21.72	9.09
Particle size distribution ¹			
% clay (< 2 µm; w/w)	26.42	25.11	9.51
% silt (2-50 µm; w/w)	65.57	36.22	36.96
% sand (50-2000 µm; w/w)	8.01	38.67	53.53
USDA classification	Silt loam	Loam	Sandy loam
US classification	Alfisol	Inceptisol	Inceptisol
Water holding capacity (g water/100 g soil)			
At pF 1.0	75.62	73.15	58.94
At pF 2.0	39.65	33.52	31.48
At pF 2.5	30.98	28.47	21.45

¹ Result expressed on mineral fraction of the dry soil basis

² Result expressed on dry soil basis

Table 2: MS concentration in soil (relative to nominal concentration)

Time [days]	Fislis	Horn	Sevelen
0	87	86	93
0	79	86	86
7	83	73	73
7	88	67	71
15	73	49	58
15	70	58	52
28	53	40	34
28	53	36	38
42	42	31	36
42	43	29	30
60	33	20	24
60	32	21	26
91	19	12	16
91	18	12	15
120	12	6.9	9.0
120	13	6.4	8.8

Figure 1: Dissipation of MS from Fislis soil under aerobic conditions

MS_soil biot_Fislis MRID 48574829-PMRA# 2181250

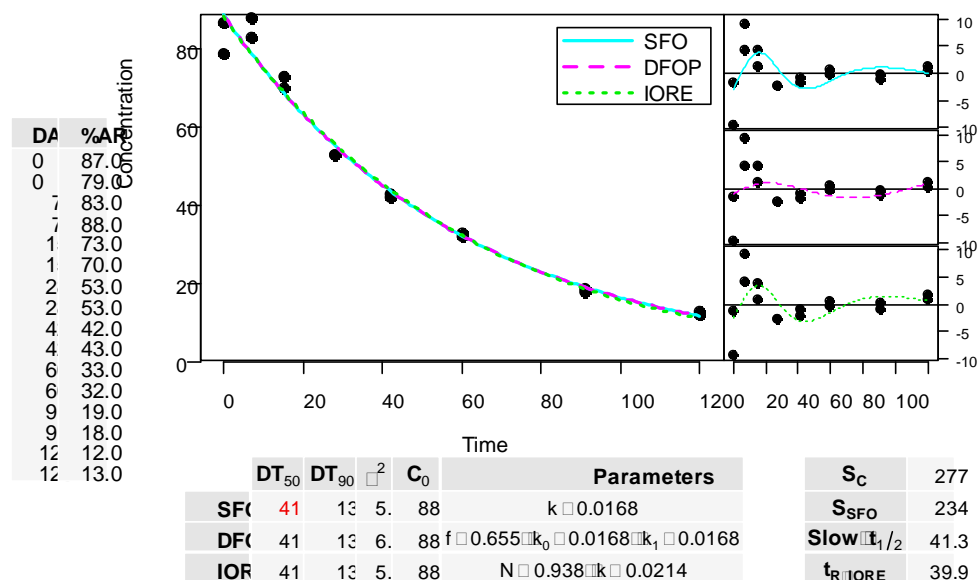


Figure 2: Dissipation of MS from Horn soil under aerobic conditions

MS_soil biot_Horn MRID 48574829-PMRA# 2181250

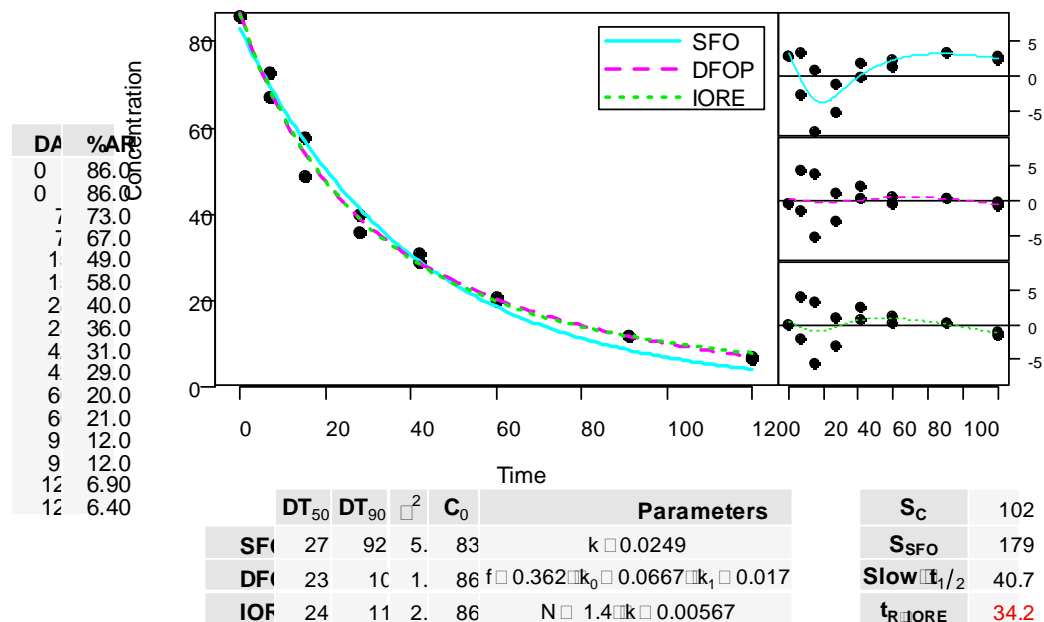


Figure 3: Dissipation of MS from Sevelen soil under aerobic conditions

MS_soil biot_Sevelen MRID 48574829-PMRA# 2181250

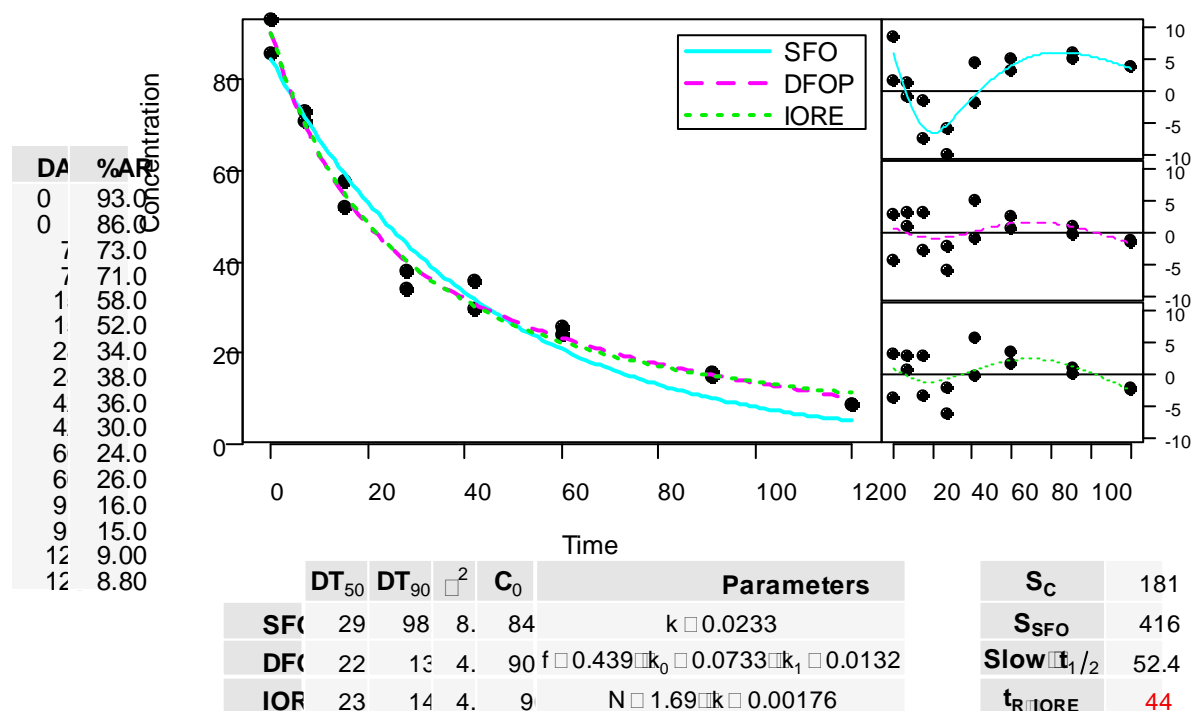


Table 3: Summary of aerobic biotransformation dissipation of MS from France and Switzerland soils under aerobic conditions.

	DT ₅₀ (days)	DT ₉₀ (days)	T _R	Model	Classification
Fislis (I, Alfisol, silt loam; France)					
Study author ¹	41.3	137	41.3	SFO	Slightly persistent
PMRA	41.3	137	41.3	SFO	Slightly persistent
Applicant	41.3	137	41.3	SFO	Slightly persistent
Horn (III, Mollisol, loam; Switzerland)					
Study author	27.8	92.4	27.8	SFO	Slightly persistent
PMRA	24.1	113	34.2	IORE	Slightly persistent
Applicant	27.8	92.4	27.8	SFO	Slightly persistent
Sevelen (VI, Inceptisol, sandy loam; Switzerland)					
Study author	29.8	98.9	29.8	SFO	Slightly persistent
PMRA	23.1	146	44	IORE	Slightly persistent
Applicant	29.8	98.9	29.8	SFO	Slightly persistent